A FARM BASED MODEL TO TEST THE SUITABILITY OF NEW COTTON CROPPING SYSTEMS WITH FARMERS IN MALI

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Introduction

Mali's cotton production was doubled and nears record levels in the last decade attributed to the increased planted area, as well as favourable weather and few pest problems. However, this record wasn't followed by an improvement of cotton productivity (i.e. yield's level) which practically stagnated since several years (IER/CMDT/OHVN, 1998). To enhance cotton's yield, agronomic researchers have proposed new cropping techniques more efficient and suited to a wide range of socioeconomic and biophysical conditions. The new techniques are usually designed at the plot level within research stations and sometimes in farmers' plots. Their adoption by farmers has been slow. To facilitate their adoption by the farmers, it appears necessary to establish a dialogue between the agronomic research and the farmers. To assist this dialogue a farm model, developed within the EU FP6 SEAMLESS project, was used. Named FSSIM (i.e. Farm System Simulator), this model consists of a non-linear programming model calibrated at the farm level. It was applied to representative farms, in order to (i) identify farms' bottlenecks, (ii) test the suitability of new cropping patterns at the farming system level, (iii) define new areas for joint research on new cropping techniques, and (iv) improve the quality of the technical exchanges with farmers.

Methodology

The used method in this study was based on the farm model "FSSIM" developed within the EU FP6 SEAMLESS project. The principal specifications of this farm model are: (i) a static model with a limited number of variants depending on the farm types and conditions to be simulated. Nevertheless, for incorporating some temporal effects, agricultural activities are defined as "crop rotations" and "dressed animal" instead of individual crops and animals; (ii) a risk programming model with a basic specification relating to the Mean-Standard deviation method in which expected utility is defined under two arguments: expected income and risk; and (iii) a positive model in the sense that its empirical applications exploit the observed behaviour of economic agents and where the main objective is to reproduce the observed production situation as precisely as possible (Louhichi et al, 2006).
The application of FSSIM model has required the following steps: (i) classifying the farms in homogeneous groups in order to cover the diversity of farming systems; (ii) defining the group of researchers and farmers to be involved in the discussion as well as their corresponding roles; and (iii) selecting the principal cotton cropping techniques to test and their implementation in FSSIM model.

Results

The model was applied to the three identified farm types, however, for several reasons we have decided to show in this paper the results of only one farm type called "large farm". The main characteristics of this farm type are an extensive agro-sylvo- pastoral system based on cotton crop grown on biennial and triennial rotations and a farm size around the 12 ha. Graph 1 illustrates the calibration degree of the FSSIM model in the selected farm type. It shows a relative correct approach of the real decision-making process of farmers, for both the bio-technical management and the economic results. Indeed, the percent deviation between the observed and the simulated area of the principal crops such as cotton, sorghum, millet and mani doesn't exceed 2 percent. The only difference was represented by the substitution of groundnut by maize which is over-estimated. However, it is necessary to recall that only the current cropping techniques were taken into account in the calibration

phase. Farmers and researchers have approved the results of the calibration phase and have judged positively the model quality.

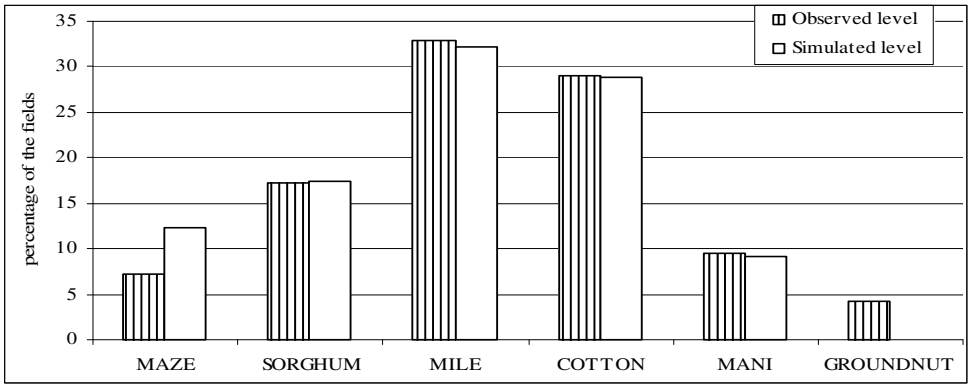

Fig. 1. Comparison between the observed and simulated crop patterns

After model calibration and validation, we started simulation by including the new cotton techniques as alternative techniques that can be selected by the model. The results of this simulated scenario are shown in the following Table. These results are compared to those of the calibration phase (called “reference run”) in order to detect theirs technical and economic results.

Table 1. Comparison between reference and simulated scenarios

		Reference run	**Scenario (% deviation to reference run)**
Farm income FCFA		1517351	+ 2
Crop pattern	Cotton – with old techniques	3.44	- 34
	Cotton – with new techniques	0	+ 66
	Maize	1.47	- 10
	Mile	3.83	+ 40
	Mani	1.08	+ 7
	Sorghum	2.07	+11

As shown in Table 1, the adoption of new cotton cropping techniques induces better performances in economic term due to the high profitability of these techniques. In term of cropping pattern, the introduction of new techniques leads to a small increase of cotton area as well as a replacement of old techniques by the new one. However and as expected, the model chooses to adopt partially the new cotton cropping techniques as farmer hasn’t enough financial and labour capacities to apply these techniques to all the crops. Although these results show significant tendencies, they must be interpreted with caution according to the assumptions retained and to the choices made by the model.

Conclusion

Even if the generated results from FSSIM seem exaggerate the positive impact of these new techniques and couldn’t reflect the plausible situation, this test case shows the relevance and the adaptability of this kind of tool to assist the dialogue between researchers and farmers while developing new technology as well as to accompany farmers and decision makers in their considerations on the future control of farms in a dubious environment.

References

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